

THE SURVEY FORMATION-MONOGRAPHS.<sup>1</sup>

BESIDES the descriptions of districts and the explanations of the published maps and sections, the Geological Survey has of late years issued treatises upon separate formations. In these a full description is given of certain geological horizons the survey of which has been completed or so nearly finished that there is no probability of any important change of classification being called for. The subject is exhaustively treated, the palæontological and petrological characteristics of the group are described, and its relation to the equivalent geological deposits on the Continent discussed. The work before us is the second of three volumes on the Cretaceous rocks. The first volume dealt with the Lower Cretaceous, the second, which has just been published, being devoted to the Lower and Middle Chalk, and the third, which it is hoped will be published this year, completing the monograph with a description of the Upper Chalk, the discussion of some postponed economical and geographical questions, and the full list of Chalk fossils.

The authors are of opinion that none of the lithological names hitherto applied to portions of the Lower Chalk can be used without confusion or inconsistency, and find themselves compelled to seek a more satisfactory method of subdivision in the limitation of the range of certain species of fossils. Nor do they seem to regard with much more favour the use of names derived from localities. We must be careful, however, in the advance towards fuller knowledge of details not to sacrifice precision to consistency. A locality can always be found, and when we get there we can generally see what an author meant. Fossils are not always forthcoming, and from the nature of the case frequently turn up where not found before. Moreover, the names of fossils are being too often changed. Palæontology, in its present phase, is a very useful handmaid in geological classification, but a very exacting mistress in nomenclature. The zone of *Terebratulina gracilis*, for instance, is so called after a form of doubtful determination, unsettled name, and inconstant occurrence.

It is interesting to follow the authors when they point out and explain the changes in the Cretaceous rocks as they trace them from one area to another. In the south-west, coarse sand and grit take the place of chalk, and suggest that we are getting near the shore of the Cretaceous sea, and that newer beds crept over the older deposits which are seen at the base further east, where the land went down first. So Barrois has observed that certain beds in the north-east of France thin out as they approach the Palæozoic ridge, while the Lower Chalk in the south-west is represented, as in the Sarthe, by sands and sandstones. Chemical and mineralogical examination tells the same tale. The fine mud, which in Wilts furnishes 16 per cent. of the material, increases in the deposits of the same horizon as we trace them to the N. and N.E. to 28 or 41 per cent. Minerals which are well known constituents of the granitic rocks of the south-western counties occur in the Lower Chalk of the far south-west, but have not been found in the corresponding beds of the midlands.

Many interesting subjects for investigation are suggested by an examination of the Cretaceous series. The replacement of portions of the chalk by flint might at first seem to require only depression to such a depth that the temperature of the included water would be sufficiently raised to carry silica in solution, while the pressure was so great that the chalk-dissolving acids

would be retained in it. But there are other factors of which we must take account. The arresting or retarding of the percolating water had something to do with it, as may be inferred from the manner of occurrence of tuberos and tabular flint along the bedding and joints, and the limitation of flint over large areas to certain horizons so constantly that their abundance or absence was long taken as a sufficient indication of the horizon. So also the supply of silica from spicules in the upper part, or the presence of much siliceous sand in the lower part, must be taken into consideration.

Phosphatic nodules, which occur at widely separated horizons from the Bala Limestone to the Crag, are peculiarly variable in character and mode of occurrence in the Cretaceous series, and from their economic value and scientific interest call for discussion. Some of them are derivative from older beds, and the area from which they have drifted has been pretty clearly made out, but that only pushes the question into other associations; the difficulties remain. There is generally evidence of a change in conditions of deposit where they occur, but it does not often point to a stationary period when animal life was abundant and sedimentation slow, which appear to be the conditions required in explanation.

The name clunch is applied to any chalk which is used as a building stone, whether it is obtained from the firmer beds in the marl, or from the Totternhoe stone or even from higher horizons. Where the Totternhoe stone is accessible it is preferred. It has been largely used at Ely, Burwell, and elsewhere for internal decorative work, and if cared for has often lasted wonderfully, even where exposed to the action of the weather. Near Reach it has been quarried from Roman times, as proved by its having been used in the basement of the Roman villa found near the railway east of the village.

The Red Rock of Hunstanton, &c., does not find a place in this volume, because it was not considered to be part of the Lower Chalk, but was regarded as the representative of the gault, and was accordingly described in the previous volume. Other red beds, however, occurring at higher horizons in the chalk are duly noticed. The Lower Greensand, which is green in borings, is foxy-red or yellow at the outcrop. This is clearly due to the percolation of water from the escarpment. There is much to suggest that the Red Chalk of Hunstanton may have sucked up the colour by capillary attraction from the underlying Car-stone. The red colour does not, however, always coincide with bedding planes, and the irregular occurrence of red beds in the chalk described in this volume is not so easily explained.

The memoir is an able exposition of the results which have been arrived at by long and careful work concentrated upon certain definite geological horizons, but illustrated by wide observation and study. It well supports the prestige of these formation-monographs, from which a large and ever increasing public derives so much benefit.

## NOTES.

WE regret to announce that Mr. Herbert Spencer died on Tuesday morning, at eighty-three years of age.

THE death is announced of Prof. Proust, the French Inspector-General of Sanitary Services.

THE ships *Morning* and *Terra Nova* left Hobart on December 6 to go to the relief of the *Discovery*, now in the Antarctic regions.

<sup>1</sup> Memoirs of the Geological Survey of the United Kingdom. The Cretaceous Rocks of Britain. Vol. ii.—The Lower and Middle Chalk of England. By A. J. Jukes-Browne, with contributions by Wm. Hill. Pp. xiii+568+plates. (London: H.M. Stationery Office, 1903.)

THE Rev. T. R. R. Stebbing, F.R.S., has been elected zoological secretary, and a member of the council, of the Linnean Society in succession to Prof. G. B. Howes, F.R.S., who has had to retire on account of ill-health.

PROF. W. D. HALLIBURTON, F.R.S., has been selected to give the Herter lectures in connection with the University of New York in the coming year, and he has chosen as his subject the biochemistry of muscle and nerve. The lectures will commence on January 4, 1904.

A SERVICE in memory of the late Sir Frederick Bramwell, Bart., F.R.S., was held at St. Margaret's Church, Westminster, on Friday last, December 4. The service was attended by a large congregation, which included representatives of the Royal Society, British Association, Institution of Civil Engineers, and many other scientific and technical bodies.

A DALZIEL message states that, having successfully exchanged messages regularly between Berlin and Munich, a distance of about 500 miles, the German Wireless Telegraphy Company is about to endeavour to establish communication between Berlin and the Swedish coast near Stockholm, a distance of more than 650 miles. The company uses a combination of the Slaby-Arco and Siemens systems.

MR. F. F. FRANCIS, Queen's Road, Wimbledon, writes to record an instance of a snake being killed by a mouse. An ordinary grass snake which he had in confinement was given a mouse for food. The snake made several attempts to catch the mouse, but in every case missed. The next day the snake was found to be dead, and there was evidence that it had been attacked and killed by the mouse, which was alive and had eaten a part of the snake's body.

AN open competitive examination for not fewer than twenty-four situations as assistant examiner in the Patent Office will be held by the Civil Service Commissioners in January next. The examination will commence on January 5, and forms of application for admission to it will probably be ready for issue in the course of a few days; they will be obtainable on request addressed by letter to the secretary, Civil Service Commission, Burlington Gardens, London, W.

THE Aberdeen Line steamer *Sophocles* arrived at Plymouth on December 3 from Sydney after experiencing exceptional weather in the Bay of Biscay. It is reported that during a severe thunderstorm the ship was struck by lightning, and the mainmast was scorched and blackened. A few minutes later, it is said, a brilliant meteor burst in the vicinity of the liner. "The attention of the passengers was attracted by a rushing sound, and immediately afterwards they saw an object plunge into the sea, apparently a few yards distant, on the starboard side of the liner, throwing up the water with a great splash."

PROF. L. C. MIALI, F.R.S., has been elected Fullerian professor of physiology at the Royal Institution. The following are among the lecture arrangements at the Institution before Easter:—A Christmas course of lectures (adapted to a juvenile auditory) on extinct animals, by Prof. Ray Lankester; Prof. L. C. Miall, six lectures on the development and transformations of animals; Dr. E. A. Wallis Budge, two lectures on the doctrine of heaven and hell in ancient Egypt, and the books of the underworld; Mr. G. R. M. Murray, three lectures on the flora of the ocean; Mr. A. D. Hall, three lectures on recent research in agriculture; Prof. H. L. Callendar, three lectures on electrical methods of measuring temperature; and six lectures by

Lord Rayleigh on the life and works of Stokes. The Friday evening meetings will begin on January 15, when a discourse will be delivered by Lord Rayleigh on shadows; succeeding discourses will probably be given by the Rev. Walter Sidgreaves, Mr. D. G. Hogarth, Mr. H. Brereton Baker, Mr. Alexander Siemens, Prof. W. Stirling, Prof. F. T. Trouton, Prof. Dewar, and other gentlemen.

MR. W. T. GIBSON has been appointed curator of the station of the Marine Biological Association of the West of Scotland, and Mr. J. M'Kenzie has been appointed assistant curator. Mr. Gibson is an associate of the Royal College of Science in London, and received his scientific education there, and also at the University of Edinburgh. He has done marine field work at the Gatty Laboratory, St. Andrews, and also at the laboratory of the Northumberland Sea Fisheries Committee at Cullercoats. Mr. M'Kenzie has for the last eight years been laboratory assistant in the zoology and geology departments of Marischal College, Aberdeen.

THE International Sanitary Conference, which has been sitting in Paris since October 10, has just closed its proceedings. A modification has been introduced in the period of surveillance in cases of contact with plague; this is reduced from ten to five days. The new convention provides for the manner in which outbreaks of cholera or plague are to be intimated, and, generally speaking, provides for greater facilities for international commerce, while giving additional guarantees for public health. It is proposed that an international sanitary office shall be established in Paris.

In a lecture upon intra-cellular bacterial toxins, delivered at the Lister Institute by Dr. Allan Macfadyen, the method of mechanically grinding bacteria with the aid of liquid air was demonstrated. The lecturer pointed out that there were two classes of bacteria, one, of which diphtheria and tetanus were examples, excreting, as it were, soluble poisons or toxins into the culture medium, the other producing no extra-cellular poisons, and in which the toxins seem to be associated with the bacterial cells, as is the case with tubercle, typhoid, cholera, plague, and a number of others. By disintegrating the cells of the last-named class, the intra-cellular toxins are set free, and on injection into animals produce toxic effects. By cautious injection with these intra-cellular toxins, the blood of the treated animal acquires antitoxic properties, and it is hoped that it may be possible by this means to obtain antitoxic sera for such diseases as typhoid fever and plague, similar to those now employed for diphtheria and tetanus.

SIR PATRICK MANSON, F.R.S., delivered an address on Monday afternoon at the London School of Tropical Medicine on the work of the school, the occasion being the departure of Sir Francis Lovell, the dean, for the East on behalf of the school. Sir Patrick Manson, having traced the history of the foundation of the school, paid a tribute to the late Colonial Secretary, who has done so much to forward the study of tropical medicine. With regard to the work of the school, it naturally came under two headings—education and research. Since the school was opened in October, 1899, no less than 354 students had passed through its portals. Research had been prosecuted so far as the limited means at their disposal had permitted. Dr. Low had shown that the filaria was introduced into the body by a mosquito, Drs. Low and Sambon had carried out an important experiment to prove the mosquito-malaria theory, Dr. Forde, a pupil of the school, had discovered a trypanosome in man, and Dr. Castellani had observed a trypanosome in sleeping sickness. Through the generosity

of Sir John Craggs a travelling scholarship of 300*l.* a year had been bestowed for three years, and the same donor now gave a valuable prize annually for the best piece of research work carried out by a pupil of the school. The need for further funds was emphasised if the work of the school was to be successful in the future. Sir F. Lovell in a previous mission to the East had collected a considerable sum of money, 100,000 rupees being contributed by the Hon. B. Petit, of Bombay.

THE suggestions made by Sir Oliver Lodge at the Physical Society on November 13 (see p. 94) as to the possibility of dissipating fog by discharge of electricity into the air have attracted much attention. Experiments proving how a smoke-filled chamber could be cleared by the discharge were shown by Sir Oliver Lodge twenty years ago, and have been repeated by many lecturers since then, but no installation on a large scale was established. In reply to a correspondent who has asked whether street arc lamps could be utilised for the purpose, Sir Oliver Lodge says, "Your suggestion seems a practical one, and it would be a very good thing if something of that kind could be done. The difficulty is the insulation. If that could be guaranteed, the matter would be comparatively easy; but the potential is extremely high—say 100,000 volts. The quantity is next to nothing, and very little power is sufficient if only one could avoid leakage. I can tell you the kind of insulators that we employed for the single mast that I used in Liverpool, but it is a very different thing to try to distribute it over a number of street lamps. It is a matter very well worth consideration, however, and I am glad to find that your attention is called to the matter. In the Liverpool experiment I was using a potential higher than 100,000 volts; one could take sparks 4 inches long. But a good deal smaller voltage would do if there are walls or other earthed surfaces in the neighbourhood. For a lofty isolated mast the potential must be higher in order to secure adequate discharge."

At the meeting of the Institution of Civil Engineers on November 24, Dr. H. R. Mill read an interesting paper on the distribution of mean and extreme annual rainfall over the British Isles. The results, which were exhibited by isohyetal lines, or lines of equal rainfall, were based on the means of thirty years, 1870 to 1899, and showed that a mean annual fall under 25 inches occurs in three places:—(1) a very narrow strip round the Moray Firth; (2) a triangular area about the Thames estuary; and (3) a large portion of east central England south of the Humber; and that the amount increases in various districts, in which altitude and configuration of the land form important features, to 40 inches and upwards. Falls of more than 100 inches are found:—(1) in the lake district, around Seathwaite; (2) in the western Highlands; and (3) in the Snowdon district. The average rainfall, to the nearest half-inch, for each country is given as follows:—England 31.5, Wales 49.5, Scotland 47.0, Ireland 42.0 inches, and for the whole of the British Isles 39.5 inches. The extremes of annual rainfall were discussed by taking out the figures for the driest and wettest year of the thirty years' period. The excess of rainfall in 1872 was stated to be 34 per cent., and the deficiency in 1887 23 per cent. of the average fall for the British Isles as a whole. The average rainfall over the whole of the British Isles for these two years was:—in 1872 53 inches, and in 1887 30.5 inches.

We have received a prospectus of a new fortnightly meteorological bulletin, entitled *La Previsione del Tempo*, to be published in Rome on the 1st and 16th of each month, under the superintendence of Father A. Rodriguez. The

bulletin will consist of eight large octavo pages, four of which will be occupied by diagrams exhibiting the principal meteorological data, and will form the basis for the calculation of the proposed predictions. These data will refer to some of the chief places in Europe (including Ireland), Algeria, and Tunis, for each of which forecasts are to be drawn. The remaining four pages will consist of text, and will contain a brief summary of the atmospheric changes of the preceding period, forecasts for the succeeding period, meteorological notes, and the fundamental principles of the system of prediction employed. The author has set himself a difficult, and we fear an impracticable, task, but as he apparently proposes to proceed upon strictly scientific lines, we shall be interested to learn what amount of success he may obtain. For this country at least, the changes from one type of weather to another appear to be too sudden to allow of a tolerably safe forecast for more than a day or two in advance, nor has more been yet attempted by any of the European central meteorological offices. The author, however, appears to be sanguine of obtaining a success of 65 to 75 per cent.

IN the Meteorological Office pilot chart for December the attention of mariners is directed, in a lengthy description of the Aurora Borealis, to the question of more careful and systematic observations of the various phases of auroræ. They are asked to supply details as to the following points, to which scientific inquiry might be directed:—The angle which the apex of the arch makes with the horizon; the orientation of the arch or arches; the lateral motion of the streamers, whether from right to left or left to right; does the individual streamer move sideways, or do fresh streamers arise to one side of the former? As a rule, streamers are parallel to the dipping needle—it should be noted if any streamers are curved. Can stars be seen immediately under the base of streamers? It should be noticed if the arches always move from north (magnetic) to south, and, if so, whether it is by a motion southward of the individual streamers or by new streamers appearing to the south of the old ones; the formation of coronæ by streamers should be carefully watched and noted, and special notice should be taken of the behaviour of the compass when an aurora presents the appearance of a luminous curtain.

A SHORT account of the meeting of the Deutsche Gesellschaft für Mechanik und Optik which took place at Ilmenau on August 14 and 15 is given by Prof. L. Ambronn in the *Physikalische Zeitschrift* for November 15.

THE *Verhandlungen* of the Deutschen zoologischen Gesellschaft for the present year contains the papers read at the session held in Würzburg on June 2-4. In the obituary notices reference is made to the loss sustained by zoological science in the death of Prof. G. Radde, of Tiflis. The papers, which are for the most part short, cover a wide range of subjects, but there are none among them which call for special notice.

WE have received a copy of Prof. W. B. Benham's presidential address to the biological section of the Australian Association. The subject is the geographical distribution of earth-worms and the palæogeography of the Antarctic region. In the first place, from their invariable association with angiospermous plants, the author is of opinion that earth-worms form a comparatively modern group, which did not attain any important development before the Cretaceous. The ancestral type would appear to have been more or less nearly related to the existing *Notiodrilus*, of which the headquarters, if not the birthplace, was the "Melanesian plateau." New Zealand and the neighbour-



ing islands, which possess the most ancient worm-fauna, were separated at an early date from this plateau. From this area the primitive worms travelled in one direction into the Austro-Malayan countries, while in another, by way of Antarctica, they reached South America and Africa. Other theories as to former land-connections in the southern hemisphere are propounded.

IN the *Transactions* of the South African Philosophical Society Dr. Bolas and Major Wolley-Dod have published a list of the flowering plants and ferns of the Cape Peninsula, and have thereby brought to notice a flora which presents a number of unique features. In the first place, from an area of rather less than 200 square miles, they report more than 2000 flowering plants, and amongst these there are a number of representatives of such uncommon orders as Selaginaceæ, Restiaceæ, and Proteaceæ. Another striking character is the richness in species of several genera; thus *Erica* possesses no fewer than 92 species, *Mesembryanthemum* shows 61, while the very rare genus *Restio* has as many as 29 representatives.

MUCH uncertainty has existed as to whether or no the bacterial cell possesses a nucleus. Some have considered that it does not, others that it contains a fragmented one, or one of the ordinary type, or that the whole cell is a naked nucleus. Profs. Rayman and Kruis (*Bulletin Acad. des Sciences de l'Empereur François Joseph I.*, June 5) claim to have shown by a special staining method that a nucleus is present in the form of a small round body situated at about the centre of the cell. In order to demonstrate this structure, films are prepared on perfectly clean cover glasses, dried in a desiccator, treated with a mordant of iron-alum, and stained with a dye known as alizarine PS, or its constituents. The paper is illustrated with some excellent reproductions of photographs.

WE have received the *Transactions* of the Leicester Literary and Philosophical Society for the session 1902-3. The volume also contains the report of the council and the annual reports of the sections into which the Society is divided for working purposes. Numerous papers are reprinted, and some of them are well illustrated. The volume is published at sixpence by Messrs. Thornley and Waddington, of Leicester.

A THIRD edition of Prof. James Walker's "Introduction to Physical Chemistry" has been published by Messrs. Macmillan and Co., Ltd. A new chapter on electromotive force has been added, and the chapter on thermodynamical procs has been extended. In cases where recent researches have made it possible, more accurate numerical values and better illustrative examples have been substituted in the text.

THE current number of the *Quarterly Journal* of the Royal Meteorological Society is an interesting one. Dr. W. N. Shaw, F.R.S., in a paper containing several instructive figures, gives a detailed analysis of the meteorological aspects of the storm of February 26-27. Mr. C. P. Hooker discusses the relation of the rainfall to the depth of water in a well; Mr. W. Marriott examines the available observations in connection with the frost of April, and Mr. J. Baxendell gives illustrated descriptions of the Dines-Baxendell anemograph and the dial-pattern non-oscillating pressure-plate anemometer.

It is now the common practice to illustrate lectures and demonstrations in most schools and colleges by means of the lantern and lantern-slides. Those teachers and lecturers

who have not mastered the art of making their own slides would do well to study the lists of slides which are to be purchased from Messrs. Newton and Co., of Fleet Street, London. We have received from this firm a supplementary list of slides to illustrate scientific and other subjects, and among them we notice sets dealing with the growth, structure, and defects of timber; the evolution of a frog; the bacteriology of tropical diseases; and the open-air cure for consumption.

A NEW illustrated catalogue of chemical apparatus recently published by Messrs. F. E. Becker and Co., of Hatton Wall, London, is one of the most complete and conveniently arranged that we have examined. Every item in the list is illustrated by a figure immediately adjoining it, and the unusually full index makes reference very easy. The catalogue gives information concerning all forms of chemical apparatus in general use in laboratories, and an exhaustive list of chemicals, reagents, and standard solutions is also included. Teachers of chemistry, and those who are engaged in chemical research, should obtain a copy of the catalogue to keep in their laboratories for reference.

A TRANSLATION of a long thesis on radio-active substances, presented to the Faculté des Sciences de Paris by Mme. S. Curie, is concluded in the current number of the *Chemical News* (December 4). The conclusions read as follows:—"I will define, in conclusion, the part I have personally taken in the researches upon radio-active bodies. I have investigated the radio-activity of uranium compounds. I have examined other bodies for the existence of radio-activity, and found the property to be possessed by thorium compounds. I have made clear the atomic character of the radio-activity of the compounds of uranium and thorium. I have conducted a research upon radio-active substances other than uranium and thorium. To this end I investigated a large number of substances by an accurate electrometric method, and I discovered that certain minerals possess activity which is not to be accounted for by their content of uranium and thorium. From this I concluded that these minerals must contain a radio-active body different from uranium and thorium, and more strongly radio-active than the latter metals. In conjunction with M. Curie, and subsequently with MM. Curie and Bémont, I was able to extract from pitch-blende two strongly radio-active bodies—polonium and radium. I have been continuously engaged upon the chemical examination and preparation of these substances. I effected the fractionations necessary to the concentration of radium, and I succeeded in isolating pure radium chloride. Concurrently with this work, I made several atomic weight determinations with a very small quantity of material, and was finally able to determine the atomic weight of radium with a very fair degree of accuracy. The work has proved that radium is a new chemical element. Thus the new method of investigating new chemical elements, established by M. Curie and myself, based upon radio-activity, is fully justified. I have investigated the law of absorption of polonium rays, and of the absorbable rays of radium, and have demonstrated that this law of absorption is peculiar and different from the known laws of other radiations. I have investigated the variation of activity of radium salts, the effect of solution and of heating, and the renewal of activity with time, after solution or after heating. In conjunction with M. Curie, I have examined different effects produced by the new radio-active substances (electric, photographic, fluorescent, luminous, colorations, &c.). In conjunction with M. Curie, I have established the

fact that radium gives rise to rays charged with negative electricity. Our researches upon the new radio-active bodies have given rise to a scientific movement, and have been the starting point of numerous researches in connection with new radio-active substances, and with the investigation of the radiation of the known radio-active bodies."

THE additions to the Zoological Society's Gardens during the past week include two Black-eared Marmosets (*Hapale penicillata*) from South-east Brazil, presented by Mr. J. Arthur Turner; a Short-toed Eagle (*Circæetus gallicus*) captured at sea, presented by Lieut. W. H. Colegrave, R.N.R.; four Chameleons (*Chamaeleon vulgaris*) from North Africa, presented by Mr. Thomas Yates; a Vervet Monkey (*Cercopithecus lalandii*) from South Africa, two Slender Loris (*Loris gracilis*) from Ceylon, a Blue-fronted Amazon (*Chrysotis aestiva*), a Rough-eyed Cayman (*Caiman sclerops*), five Black-pointed Teguxins (*Tupinambis nigropunctatus*) from South America, a Red-billed Toucan (*Ramphastos erythrorhynchus*) from Cayenne, two Red-handed Tamarins (*Midas rufimanus*) from Surinam, a One-bearded Greaved Tortoise (*Podicnemis unifilis*) from the Upper Amazons, deposited.

### OUR ASTRONOMICAL COLUMN.

OBSERVATIONS OF SOLAR PHENOMENA.—In a paper presented to the Paris Académie des Sciences, M. Deslandres discusses the various theories concerning the inter-relation of solar and magnetic phenomena which have been brought into prominence by the exceptional magnetic storm of October 31. He points out that, whereas the magnetic phenomena are recorded continuously at many widely separated observatories, the solar observations, which constitute the other side of the problem under discussion, are only made during short intervals each day and at fewer stations; therefore he strongly urges that solar observatories should be more widely disseminated in order that a continuous record may be obtained. Again, he points out that, at present, at least ninety-nine out of every hundred observers of the sun only record the forms, and not the movements, or velocities, of the solar disturbances, whereas in his opinion the records of the latter would prove much more effective in bringing us to a solution of the vexed questions.

M. Deslandres suggested in 1893, and in the present paper he strongly emphasises the fact, that it is essential, in order that our knowledge of solar disturbances may be rendered less defective, to obtain a continuous record of:—(1) The surface of the photosphere as photographed by the ordinary process; (2) the forms of the disturbances in the lower, mean, and higher chromosphere as obtained with the spectroheliograph; and (3) the radial velocities of these chromospheric disturbances as shown on photographs obtained with the spectroheliograph especially arranged to register these velocities. He states that the present instruments are perfect enough to ensure success, and estimates the annual expense of such observations (at Meudon) as twenty thousand francs (about 800*l.*) (*Comptes rendus*, No. 21, November 23).

THE SPECTRUM OF LIGHTNING.—Mr. Phillip Fox, of the Yerkes Observatory, has recently succeeded in obtaining several spectra of lightning flashes which were taken with an objective-prism spectroscope consisting of a 30° flint glass prism mounted in front of a camera of 35 mm. aperture and 274 mm. focal length. Proceeding on the lines suggested by the visual observations of Vogel, Lohse, and Schuster, he compared his spectra with a spark spectrum of air obtained with the same instrument, and found that a striking agreement existed between the two.

Similar results were arrived at by Dr. W. J. S. Lockyer, who, in a recent number of the *Illustrated Scientific News* (No. 15, vol. ii.), described an extremely simple method whereby photographs of lightning flashes and their spectra can be obtained by using an ordinary camera having one of Thorpe's transmission gratings fixed in front of the lens.

The spectra thus obtained by Dr. Lockyer in May of this year are shown to differ from those obtained by Prof. Pickering at Harvard in 1901, and a spectrum recently obtained by the latter is again different from either of the other two; all, however, bear a striking resemblance, in general appearance, to the air spark spectrum, the chief nitrogen lines being especially prominent.

In Mr. Fox's spectra it is seen that the various lines differ in intensity from one part of the flash to another, and, as this apparently indicates a variation of the spectrum with the atmospheric conditions, it seems probable that the differences existing between the several spectra may be thus explained.

Mr. Fox's article is illustrated by reproductions of the spectra obtained by him, and a comparison of the air and lightning spectra, and is published in No. 4, vol. xviii., of the *Astrophysical Journal*.

THE LINE SPECTRA OF THE ALKALINE METALS.—In No. 27 of the *Physikalische Zeitschrift* Herren H. Konen and A. Hagenbach record the results of some observations made by them with the object of discovering additional lines in the secondary series of the spectra of lithium, potassium, caesium, and rubidium.

In the spectrum of lithium four new lines were observed, but their diffuse character renders the determined wavelengths (6240.8, 4636.14, 4149.1, and 3934) rather untrustworthy, and for this reason it is difficult to determine finally whether they belong to a definite series or not, although it seems likely, from their character and their analogy to the lines in the sodium series, that they are really pairs, and belong to the first secondary series. No new lines were discovered in the potassium spectrum. In the spectrum of rubidium three new lines were discovered, and fourteen of the fifteen lines observed by Mr. Hugh Ramage in the flame spectrum were seen, although these observers were unable to find, either in the arc or the flame, the line at  $\lambda$  5037 recorded by Mr. Ramage. These new lines fill up gaps in the first secondary series as calculated from Kayser and Runge's formula.

All the lines recorded by Mr. Ramage below  $\lambda$  5750 in the caesium spectrum were observed, together with an additional line at  $\lambda$  5209.

### PATAGONIAN "DIPROTODONT" MAMMALS.<sup>1</sup>

SEÑOR AMEGHINO appears to be firmly convinced that the ancestors of a large number of groups of mammals are to be met with among the remains from the Santa Cruz and associated beds of Patagonia. Last year, in the journal quoted below, he attempted to prove the descent of the modern elephant, through *Pyrotherium* and certain other forms, from a primitive opossum (*Proteodidelphys*). Now he essays to demonstrate that the rodents have originated from another type of Patagonian "diprotodonts," namely, the *Garzoniidae*, which is itself traced back to a still earlier group, the *Microbiotheriidae*. Apart from zoological considerations, the possibility of such phylogenies depends entirely on the age assigned to the Santa Cruz and subjacent strata. If, with Dr. Ameghino, we regard them as of early Eocene, Cretaceous, and possibly Upper Jurassic age, then, from this point of view, there is nothing impossible in such pedigrees. If, on the other hand, we accept the view of the great majority of palæontologists that these strata are of Miocene age, the very foundations of Dr. Ameghino's elaborate phylogenies are at once destroyed.

Putting, however, this consideration on one side, we may refer briefly to some of the zoological features in the paper before us. Briefly stated, Dr. Ameghino's views, so far as we can follow them, appear to be as follows. In the Upper Jurassic of Patagonia there existed a primitive group of "diprotodonts" (that is to say, mammals furnished with a single pair of chisel-like incisors in the lower jaw), the *Microbiotheriidae*. On the one hand, as we learn from the earlier paper, these gave rise to the *Proboscidea*, while on the other they culminated in the modern rodents, the diprotodont marsupials of Australia, and certain extinct forms,

<sup>1</sup> F. Ameghino, "Los Diprotodontes del orden de los Plagiolacoides y el Origen de los Roedores y de los Polymastodontes" (*An. Mus. Nac. Buenos Aires*, vol. ix., pp. 81-192).